The Nanomaterials Pathway to Better Batteries

Lightweight Power Sources for Autonomous Devices

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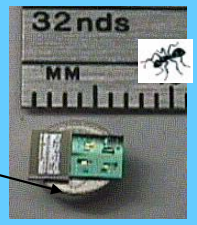
THE PROBLEM:
HIGH ENERGY BATTERIES NOT AVAILABLE FOR MICRODEVICES

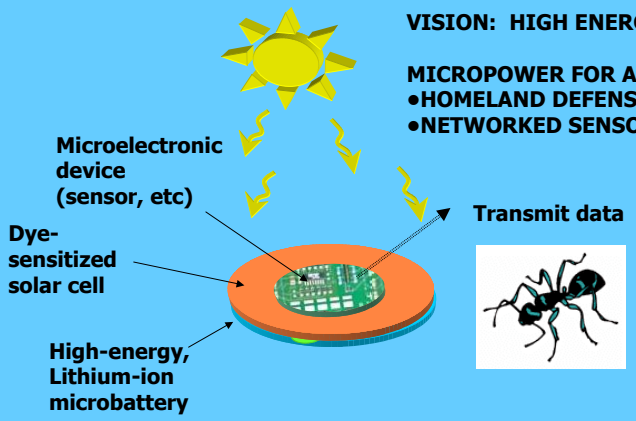


Watch Battery 5 to 10 µA

Smart Dust
K. Pister, Berkeley
DARPA/ETO MEMS Program

VISION: HIGH ENERGY BATTERY WITH ENERGY HARVESTING

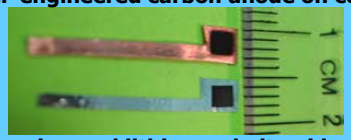
MICROPOWER FOR AUTONOMOUS MICROSENSORS AND DEVICES
- **HOMELAND DEFENSE**
- **NETWORKED SENSORS FOR SHIPS**



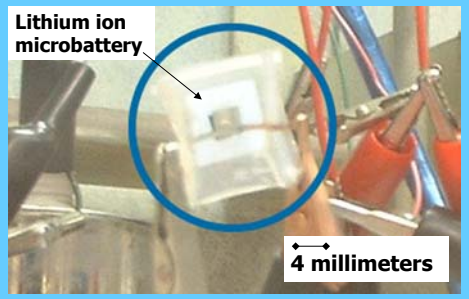
Battery harvests energy from microsolar cell - used to power microdevice

THE SOLUTION: PART 1
FABRICATE HIGH ENERGY LITHIUM MICROBATTERIES

Laser-engineered carbon anode on copper



Laser-engineered lithium cobalt oxide on aluminum



Specs on 1st generation packaged Li-ion microbattery
- **4.17 Volts**
- **100 µAh**

} **Power for mircroelectronic devices**

- **+24 cycles**
- **ambient air**

} **Durable**

THE SOLUTION: PART 2
MAKE ULTRA-LIGHTWEIGHT BATTERIES WITH NEW NANOMATERIALS

- **Build nanostructured electrodes to improve interfacial contact and ionic conductivity**
- **RESULT: Extract more energy from the battery materials and lower the weight of the battery**